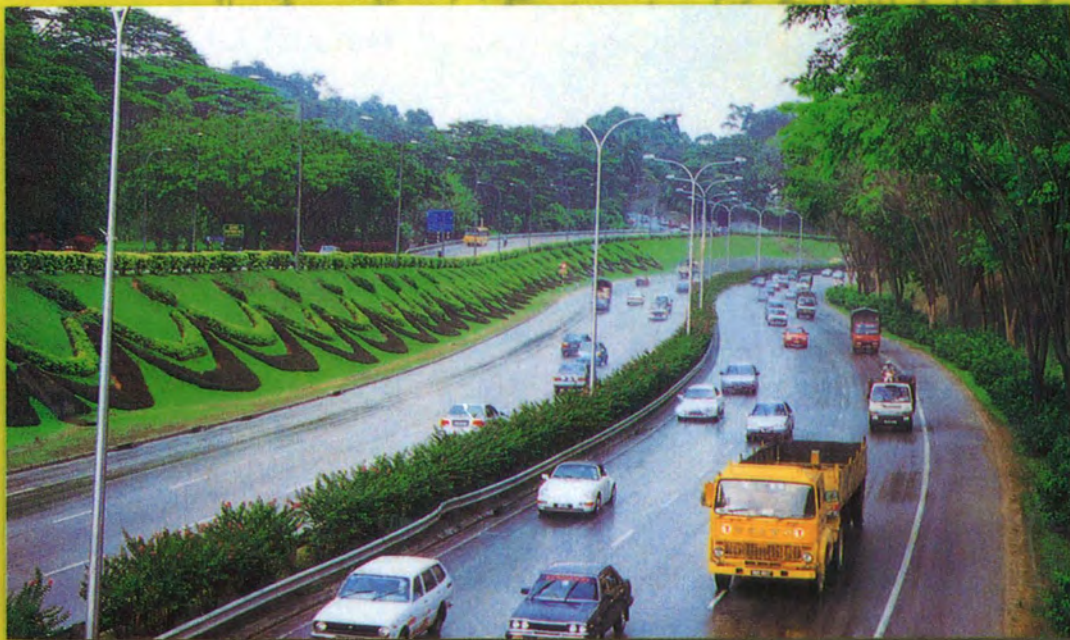


Road Safety Audit



Guidelines For The Safety Audit Of Roads And Road Project In Malaysia

TABLE OF CONTENTS

1	Introduction	1
1.1	What Is Road Safety Audit.	
1.2	Goals And Objectives of Road Safety Audit.	
1.3	Why do we need RSA.	
1.4	Organisational Commitment To Road Safety	
2	Legal Liability Issues In Road Safety Auditing	5
2.1	Introduction	
2.2	Elements Of Legal Liability	
2.3.	Principles Of Negligence Applied To Road Safety Audit.	
2.4	Procedures For Non-acceptance Of Auditor's Recommendations.	
2.5	Negligent Audit.	
2.6	Conclusion.	
2.7	Note On Duty Of Care.	
3	Road Safety Auditors	13
3.1	Skills and Experience required.	
3.2	Independence Of Auditors.	
3.3	Accreditation Of Auditors.	
4	Organisational Arrangements For Road Safety Auditing	15
4.1	Arrangements For Doing The Audit:	
4.1.1	Audit by independent RSA Specialists;	
4.1.2	Audit by other 'Road Designers' from within the Road Authority or Department;	
4.1.3	Audit carried out by a member of the project's Design Team;	
4.2	Arrangements For Assessing The Audit Report.	
5	When Should Road Safety Auditing Be Done?	19
	The 5 Stages Of RSA	
5.1	Feasibility & Planning Stage (Stage 1 Audit)	
5.2	Draft (Preliminary) Design Stage (Stage 2 Audit)	
5.3	Detailed Design Stage (Stage 3 Audit)	
5.4	The pre-opening stage (Stage 4 Audit)	
5.5	RSA of An Existing Road (Stage 5 Audit)	
6	A General Procedure for Road Safety Audit	21
6.1	Key points in the procedure	
6.1.1	Appointing the Auditor(s)	
6.1.2	Providing The Background Information Required For The Audit.	
6.1.3	Meetings	
6.1.4	Equipment Needed By The Auditor(s).	

- 6.1.5 Audit / Review Of Design Plans And Specifications.
- 6.1.6 Site Inspections.
- 6.1.7 The Use Of A Check List
- 6.1.8 Recording Of Information
- 6.1.9 The Road Safety Audit Report.

7 Guidelines For Road Safety Audit At Various Stages Of A Project

27

- 7.1 Stage 1 Audit, Planning And Feasibility Stage
 - 7.1.1 Traffic Planning And Route Standards
 - 7.1.2 Road Network Considerations
 - 7.1.3 Geometric Standards
 - 7.1.4 Provisions For Special Road Users
 - 7.1.5 Access Control
 - 7.1.6 Consideration of Alternatives
- 7.2 Stage 2 Audit, Preliminary (Draft) Design Stage
 - 7.2.1 Cross-section And Reservation Width
 - 7.2.2 Horizontal and Vertical Alignment
 - 7.2.3 General Layout Features
 - (a) Expressway Type Arterial Roads:
 - (b) Non-Expressway Type Arterial Roads
 - 7.2.4 Road safety audit of major land use developments.
 - 7.2.5 Stage Development Of Major Road Projects
 - 7.2.6 Case Study. (A Road Safety Audit at the Preliminary Design Stage)
- 7.3 Stage 3 Audit, Detailed Design Stage
 - 7.3.1 Information Required For The Stage 3 Audit.
 - 7.3.2 Audit Equipment and Aids.
 - 7.3.3 Stage 3 Audit Procedure.
 - 7.3.4 Audit of General Items Of The Project.
 - (a) Earlier Stage Audits.
 - (b) Design Criteria.
 - (c) Reservation Width And Other 'Design Constraints'.
 - (d) Driveway And Access Points.
 - (e) General Traffic Management.
 - (f) Climatic and Weather Implications.
 - 7.3.5 Audit Of Geometric Design Elements.
 - (a) Horizontal Alignment.
 - (b) Vertical Alignment.
 - (c) Combination Of Horizontal And Vertical alignment.
 - (d) Grades.
 - (e) Cross - Section.
 - 7.3.6 Audit Of Interchanges And Intersections
 - (a) General layout logic.
 - (b) Visibility And Sight Distance.
 - (i) Approach Sight Distance (ASD).
 - (ii) Entering Or Crossing Sight Distance (ESD)
 - (iii) Safe Intersection Sight Distance (SISD).
 - (iv) Sight Distance To Queued Vehicles.
 - (v) Sight Lines and Visibility to Traffic Signals and Signs.

- (vi) Sight Distance To Exit Nose and 'Gore' Area At Interchanges.
 - (vii) Sight Distance To the Entry and Merge Area.
- (c) Interchanges And Interchange Ramps.
- (d) Exit and Entry Layout, Auxiliary Lanes And Lane Continuity.
- (e) Island Size And Shape.
- (f) Kerb Types.
- (g) Provisions For Pedestrians.
- (h) Location Of Signals, Signs, Lighting And Other Road Furniture.
- (i) Vehicle Parking And Bus Stops.
- (j) Property Access Points.
- 7.3.7 Audit Of Traffic Signal Installations.
- 7.3.8 Audit Of Traffic Signing And Road Marking.
 - (a) Traffic Signs.
 - (b) Road marking and delineation.
- 7.3.9 Audit Of Street Lighting Design
 - (a) The extent of street lighting
 - (b) The standard of lighting.
 - (c) Lighting Transitions.
 - (d) Hazards caused by lighting poles.
 - (e) Sight line obstruction.
- 7.3.10 The Audit Of Roadside Safety Provisions
 - (a) Provision of a 'Clear Zone'.
 - (b) The use of Frangible Types Of Road Furniture.
 - (c) Guardrail Provisions and Design Details.
 - (d) Guard Rail Positioning Relative to kerbs and Objects being Protected.
 - (e) Bridge Ends And Guardrail To Bridge Rail Transitions.
 - (f) Barriers and Railings on Bridges and Elevated Roadways.
 - (g) Landscaping And Beautification.
 - (h) Other roadside hazards.
- 7.3.11 Audit of Provisions For Special Road Users.
 - (a) Pedestrians.
 - (b) Motorcycles.
- 7.3.12 Case Study, Road Safety Audit Stage 3 - Detailed Design
Lebuhraya Damansara Puchong (LDP) Project.
- 7.4 Stage 4 Audit, During Construction And Pre-Opening of a New Project
 - 7.4.1 Site Inspections.
 - 7.4.2 Things To Look For During Site Inspections:
 - (a) Horizontal and Vertical Alignment And Cross- section.
 - (b) General Roadway Layout Features.
 - (c) Traffic Signing And Roadmarking.
 - (i) Traffic Signs:
 - (ii) Roadmarking:
 - (d) Roadside Safety Features.
 - (e) Landscaping.
 - (i) Landscaping Obstructing Sight Lines
 - (ii) Landscaping Features which may be Potential Roadside Hazards?

- (iii) Effects of trees on street lighting
 - (iv) Other landscaping aspects to consider
- 7.4.3 Audit Of Traffic Management During Construction And Maintenance,
 - (a) Review Of Traffic Management Plans.
 - (b) Inspection Of Traffic Management Arrangements.
- 7.4.4 Case Study (A Post-Construction / Early Operational Stage Audit) Federal highway Route 2, (Kuantan - Gambang Rd), Pahang.
- 7.5 Stage 5 Audit, Audit Of Existing Roads
 - 7.5.1 Site Inspections
 - 7.5.2 What to look for on the site inspection?
 - (a) Vertical And Horizontal Alignment.
 - (b) Cross-section
 - (c) Intersections
 - Sight Distances
 - Layout Features Of Intersections
 - (d) Expressway interchanges and other grade separated intersections
 - (e) Traffic Signal Installations
 - (f) Traffic Signing - General Aspects
 - (g) Regulatory and Warning Signs
 - (h) Guide and Direction Signs
 - (i) Pavement Marking
 - (j) Roadside Safety and Landscaping
 - (k) Street Lighting
 - (l) General Traffic Management Items
 - 7.5.3 Case Study

8 Road Design For Safety

137

- 8.1 Introduction
- 8.2 Human Factors
 - 8.2.1 Vision.
 - 8.2.2 Information Needs
 - 8.2.3 Information Processing
 - 8.2.4 Other important human factors
 - Expectancy
 - Reaction Time
 - Short Term Memory
- 8.3 Vehicle Characteristics
 - 8.3.1 Visibility (For The Driver)
 - 8.3.2 Braking Characteristics
 - 8.3.3 Manoeuvrability
 - 8.3.4 Cornering
- 8.4 General attributes of safe roads
- 8.5 Some Principles Of 'Design For Safety'
 - 8.5.1 Intersection Locations
 - 8.5.2 Road Links Between Intersections
- 8.6 Safety Hints In Geometric Design

- 8.6.1 Cross-section
 - (a) Right-of-Way width
 - (b) Lane Width
 - (c) Footpaths and Verge
- 8.6.2 Grading and Drainage
- 8.6.3 Horizontal And Vertical Alignment
- 8.6.4 General Roadway Layout
- 8.6.5 Intersections
- 8.6.6 Interchanges
- 8.6.7 Traffic Signals
- 8.6.8 Traffic Signs
- 8.6.9 Pavement Marking And Delineation
- 8.6.10 Roadside Safety Features
- 8.6.11 Street lighting
- 8.6.12 Landscaping

References And Bibliography

154